Sulf

The concentration of dissolved sulfate in water from permeable zone E, based on median values of all samples in each 100-square-mile area, ranges from 0.4 mg/L in the outcrop area west of the Mississippi River to 5,300 mg/L near the downdip limit of the data in southern Texas (table 1). Between the Sabine arch and the Mississippi River the concentration generally increases from outcrop to the downdip limit of the permeable zone (fig. 13). Elsewhere there appears to be no specific trend in

From the Mississippi River eastward to the western edge of Florida and from outcrop to downdip limit of the data the concentration generally ranges from less than 5 to 20 mg/L. From the Mississippi River westward to the Sabine arch the concentration in the outcrop and in the area from outcrop to middip generally ranges from 5 to 20 mg/L. From middip to the downdip limit of the permeable zone the concentration increases to 100 mg/L in southern Louisiana.

From the Sabine arch southwestward to the Rio Grande the concentration of dissolved sulfate in the outcrop generally ranges from 10 to 100 mg/L. From the outcrop to the downdip limit the concentration ranges from 10 to 500 mg/L. The pattern is one of random distribution of small and large values of sulfate concentration except in southern Texas where the concentration increases from about 100 mg/L at middip to more than 500 mg/L at the downdip limit of the data.

Chlori

The concentration of dissolved chloride in water from permeable zone E, based on median values of all samples in each 100-square-mile area, ranges from 0.2 mg/L in the middip area of southern Mississippi to 137,000 mg/L in the downdip area of southern Texas (table 1). The concentration increases from the outcrop southward to the downdip limit of the data with the largest increase over the shortest distance generally occurring near middip (fig. 14).

From the Mississippi River eastward to the western edge of Florida the concentration of dissolved chloride generally ranges from less than 10 to 20 mg/L in the outcrop and in the area from outcrop to middip except in areas along the Pascagoula and Tombigbee Rivers where it exceeds 100 mg/L. From middip to the downdip limit of the data the concentration increases to more than 1,000 mg/L. From the Mississippi River westward to the Sabine arch the concentration generally ranges from 10 to 100 mg/L in the outcrop and in the area from outcrop to middip. At middip the concentration increases from 100 to 50,000 mg/L in a distance of about 20 mi in the downdip direction in southwestern Louisiana. The concentration is about 50,000 mg/L along the downdip limit of the permeable zone.

From the Sabine arch westward to about the Colorado River the concentration of dissolved chloride ranges from 20 to 1,000 mg/L in the outcrop and increases to 20,000 mg/L at middip. Much of the area between middip to the downdip limit of the permeable zone has concentrations of 50,000 mg/L or more. From about the Colorado River southwestward to the Rio Grande the concentration in the outcrop ranges from 100 to more than 10,000 mg/L. From the outcrop to the downdip limit of the data the concentration increases to 20,000 mg/L at middip and to 30,000 mg/L at the downdip limit of the data with local areas exceeding 50,000 mg/L. The location of areas of large concentrations of chloride generally are coincident with the deeper part of the permeable zone area and with the location of salt domes (fig. 4).

Silica

The concentration of dissolved silica in water from permeable zone E, based on median values of all samples in each 100-square-mile area, ranges from 1.2 to 856 mg/L (table 1). However, the concentration generally ranges from 10 to 50 mg/L in most of the permeable zone (fig. 15). The concentration of silica tends to decrease in a downdip direction in the area between the Sabine arch and the Mississippi River and the area between the San Marcos arch and the Rio Grande.

From the Mississippi River eastward to the western edge of Florida the concentration of dissolved silica ranges from 10 to about 40 mg/L in the outcrop area and from about 10 to more than 50 mg/L in the area from the outcrop to the downdip limit of the data. From the Mississippi River westward to the Sabine arch the concentration in the outcrop ranges from 20 to 50 mg/L. From the outcrop to middip the concentration generally ranges from 20 to about 50 mg/L and from middip to the downdip limit of the permeable zone the concentration generally ranges from less than 10 to 20 mg/L.

From the Sabine arch westward to the San Marcos arch the concentration of dissolved silica generally ranges from 20 to more than 50 mg/L in the outcrop and from about 10 to more than 50 mg/L in the area from the outcrop to the downdip limit of the permeable zone. From the San Marcos arch southwestward to the Rio Grande the concentration ranges from 10 to more than 50 mg/L.

## IONIC RATIOS

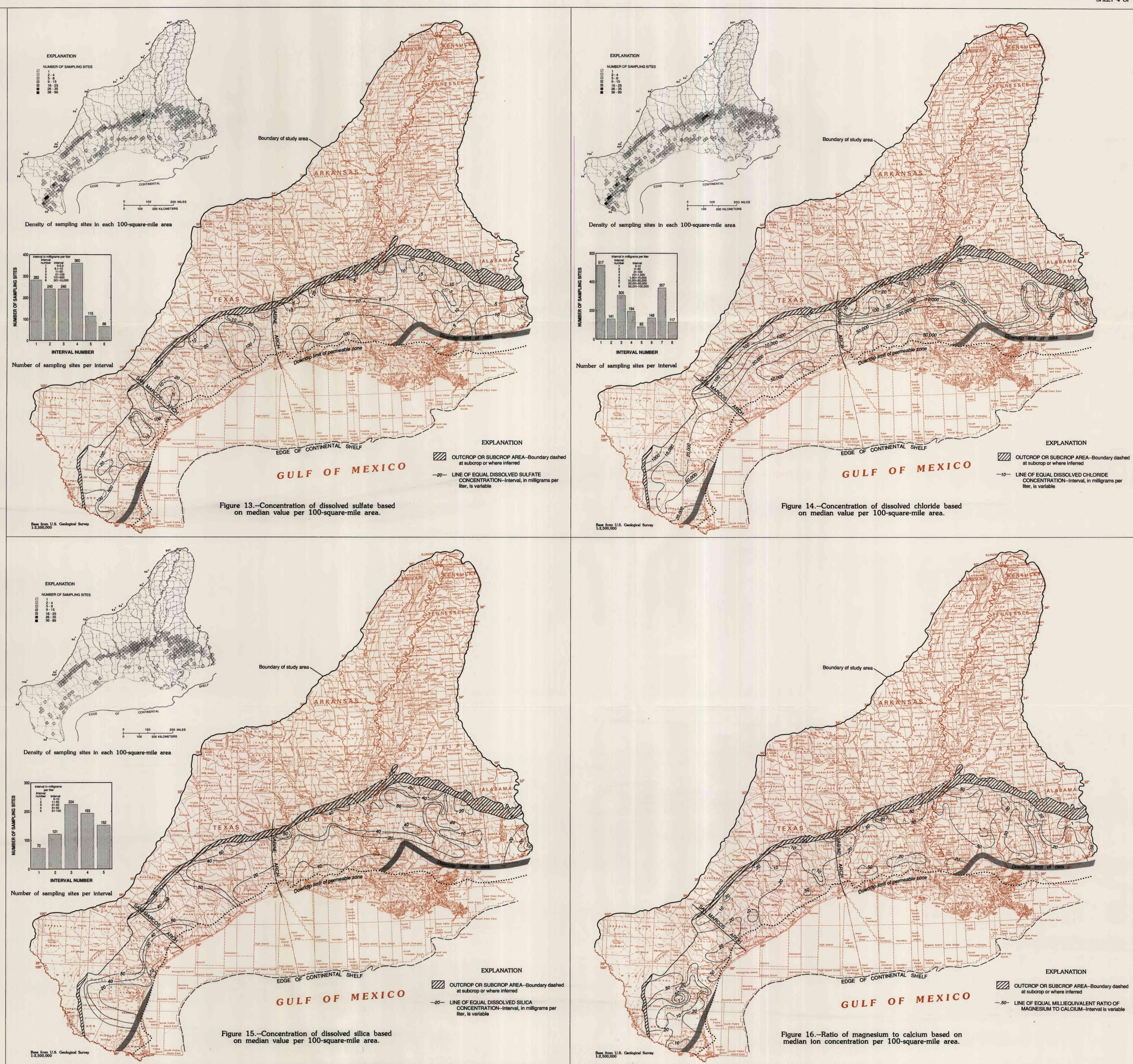
Selected ionic ratios were mapped to show any trends from outcrop to the downdip limit of the data. A characteristic of ionic ratios is that they are not affected by dilution, assuming that all constituents are diluted to the same degree. Consequently, upward leakage of brine into a freshwater aquifer would not mask the signature of the brine. For example if the brine were seawater trapped in deep sediments, the ionic ratios would remain that of seawater. Whereas if the ionic ratios are different from seawater and the concentrations of sodium and chloride are larger than for seawater, the brine could be the product of dissolution of evaporites composing salt domes.

Mapped ionic ratios can be used to show trends that may indicate processes or mechanisms that have major control on the water chemistry from updip to the downdip limit of the data. For example an ionic ratio of magnesium plus calcium to bicarbonate that is equal to 1 in outcrop areas may indicate the dissolution of dolomite or calcite. Whereas downdip of the outcrop this same ionic ratio greater than 1 indicates an additional source of calcium or magnesium ions such as would result from the dissolution of gypsum. If the downdip area is in a salt dome basin, it could indicate the dissolution of evaporites. However if this same ratio was less than 1 it indicates an increase in bicarbonate ions, which could be due to a process such as the alteration of silicates. The median ion concentration for each 100-square-mile area, expressed as milliequivalents per liter, was used to calculate an ionic ratio.

## Magnesium to Calcium

The areal distribution of the milliequivalent ratio of magnesium to calcium (Mg:Ca) in water from permeable zone E ranges from less than 0.01 in southern Texas to 5.2 near the outcrop in southwestern Alabama (table 1). For most of the area the ratio ranges from 0.1 to 0.5 (fig. 16). The map shows no general areal trend in the Mg:Ca ratio.

From the Mississippi River eastward to the western edge of Florida the Mg:Ca ratio generally ranges from 0.5 to 1 in the outcrop area and 0.2 to 1 in the area from outcrop to the downdip limit of the data. From the Mississippi River westward to the Sabine arch the Mg:Ca ratio generally ranges from 0.2 to 0.5 in both the outcrop and in the area from the outcrop to the downdip limit of the permeable zone. From the Sabine arch southwestward to the Rio Grande the Mg:Ca ratio ranges from about 0.1 to 0.5 in both the outcrop and the area between the outcrop and the downdip limit of the data except for a local area in southern Texas where it is 1.



PROPERTIES AND CHEMICAL CONSTITUENTS IN GROUND WATER FROM PERMEABLE ZONE E (LOWER MIOCENE-UPPER OLIGOCENE DEPOSITS), COASTAL LOWLANDS AQUIFER SYSTEM, SOUTH-CENTRAL UNITED STATES

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